Commercial Fisheries Abstracts

a monthly summary of important developments for the fishery industries

In this issue—

P. O. F. I. LIBRARY
JAN 29 1959
FISH & WILDLIFE SERVICE

- Darkening of Shrimp P. 3
- CTC-Treated Fillets P. 3
- Frozen Fish Packaging P. 3
- Sterilization of Canned Fish P. 5
- Light for Candling Fillets P. 9

— and 19 others

Vol. 11 No. 12 December 1958

Fish and Wildlife Service
U. S. Department of the Interior
Washington D. C.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FRED A. SEATON, SECRETARY

FISH AND WILDLIFE SERVICE
ARNIE J. SUOMELA, COMMISSIONER

Commercial Fisheries Abstracts

Prepared in the Division of Industrial Research and Services
Bureau of Commercial Fisheries

EDITORIAL STAFF

Charles Butler, Chief, Branch of Technology
Maurice E. Stansby, Chief, Pacific Coast and Alaska Technological Research
F. Bruce Sanford, Chemist
Kathryn L. Osterhaug, Fishery Products Technologist
Martin J. Heerdt, Chemist
Gladys K. Green, Editorial Clerk (Typist)

Applications for COMMERCIAL FISHERIES ABSTRACTS, which is mailed free to members of the fishery industries and allied interests, should be addressed to the Director, Bureau of Commercial Fisheries, United States Department of the Interior, Washington, 25, D.C. Fulfillment of foreign requests confined to Government agencies, research institutions, and libraries.

The Service assumes no responsibility for the accuracy of material from outside sources, and can fulfill requests for copies of the articles only if the abstract was taken from a Service publication. Readers should direct requests for other articles to the author of the article or to the publication in which it appeared. The addresses of these publications are available from the Bureau of Commercial Fisheries, Washington 25, D. C.

The abstracts in this leaflet may be left in their present form; but it is suggested that to make the most efficient use of them, they be cut on the lines designated and filed by the number in the upper left-hand corner of each. For a full description of this filing system see "Fishery Technological Abstract Card System" by Maurice E. Stansby and K. L. Osterhaug, Fishery Leaflet No. 232, obtainable free by request from Bureau of Commercial Fisheries, Washington 25, D. C.

In addition to the regular abstracts, there is included a bibliography of references of secondary importance (without abstracts). These may be cut off on the lines designated and pasted on standard 3 x 5-inch cards for filing.

Following is a brief outline of this filing system. The numbers apply to the first digit appearing on each card. For the meaning of subsequent digits, please see the above described leaflet.

0 General and theoretical	3 Preserved fish	7 Analytical Methods
1 Fish by species	4 Oils	8 Composition
2 Fresh fish	5 Vitamins	9 Miscellaneous
	6 Fishery byproducts	

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget November 23, 1956.

1.70 THE SHARK FISHERY OF THE BASS STRAITS (AUSTRALIA)

Bown, J.
World Fishing 7, 54-56 (July 1958)

Australians are among the few people in the world who eat any quantity of shark. At first it was marketed as "flake," but for several years, it has gone under its own name. The flesh of shark is snow-white, it flakes evenly, and it has no bones, making it ideal for young children.

Victoria is the main shark-eating state. More shark is sold in Melbourne than is any other variety of fish. The catch is comprised mainly of only two varieties, the schnapper or school shark and the gummy shark.

The schnapper shark is the most sought after. It is a clean feeder and is caught only on clean fresh bait. The schnapper shark appears in the Strait about September, reaches its peak from December to February, and virtually disappears by April.

The gummy shark, as its name implies, has hard bony ridges instead of teeth. It is in the Straits throughout the year and provides good fishing during the winter.

Other species of shark are taken occasionally, but although they are salable, they command a lower price than do the schnapper and gummy sharks.

The shark boat usually is about 50 feet in length and has a moulded depth of 8 feet and a beam of 15 feet. The shark are caught on long lines. The main line usually is $\frac{3}{4}$-inch R. P. sisal rope with 3-foot snoods of 72 seine cotton. Size 10/0 hooks are attached to the snoods with 4 inches of 16 or

(over)

ABSTRACTER: Kathryn L. Osterhaug

2.05 BACTERIOLOGICAL CONTENT OF MARKETED PRECOOKED FROZEN FOODS IN RELATION TO PUBLIC HEALTH

Ross, A. Doreen and Thatcher, F. A. (Department of National Health and Welfare, Ottawa, Canada)
Food Technology 12, 369-371 (July 1958)

Purpose.--Fifteen kinds of precooked frozen foods packed in the United States and Canada and purchased at retail in Canada were examined bacteriologically to assess their potential as a public health hazard and to learn of the effectiveness of the sanitation practices in use at the nine factories from which the samples were taken. These foods included dinners, meat, fish pies, poultry pies, and cooked frozen dessert pies.

Methods of examination.--Frozen foods held at -20° C. were transferred to a refrigerator at 5° C. for 10 to 12 hours to allow partial thawing before they were sampled. A 50-gram composite portion of each food was removed aseptically and comminuted with 450 ml. of sterile distilled water in a sterile Waring Blendor. Decimal dilutions up to 1:10,000 were prepared from an original 1:10 dilution. A second composite sample of 10 grams was added aseptically to 90 ml. of yeast-extract-veal-infusion broth and incubated for 18 to 24 hours as an enrichment culture prior to tests for the presence of salmonellae.

Aliquots of the decimal dilutions were plated by standard methods onto appropriate media as follows: (a) Standard counts were obtained by plating on tryptone-glucose-extract agar and incubating the plate at 37° C. for 48 hours. (b) Escherichia coli counts were obtained by plating on violet-red-bile agar and incubating the plates at 37° C. for 24 hours. (c) Enterococci counts were obtained by plating on enterococcus confirmatory agar at the rate of 30 ml. of agar per plate and incubating the plates at 45° C. for 48 hours. (d) Staphylococci were isolated by plating on phenol-red-mannitol-salt agar and incubating the plates at 37° C. for 48 hours. (e) Salmonellae were

(over)

ABSTRACTER: Martin Heerdt

2.00 RED FLESH IN REDFISH, SEBASTES MARINUS

Templeman, Wilfred and Sandeman, E. J. (Fisheries Biological Station, St. John's, Newfoundland)
Journal of the Fisheries Research Board of Canada 15, 695-700 (July 1958)

Occasional redfish with red flesh have been found in the Newfoundland area. Ordinarily the flesh of this fish is white. This study was made to learn more about the nature of the unusual red pigment.

Spectrophotometric analyses.--Reddish pink fillets from redfish taken in the eastern part of the northern Anticosti Channel at 165 fathoms were used for spectrophotometric analyses. The fillets were ground and mixed. A 21-gram sample of minced muscle was extracted for 30 minutes with 100 milliliters of acetone using a mechanical shaker. The absorption spectrum of the extract was measured at various wave lengths over the range 350 to 700 mμ in a Beckman spectrophotometer. Maximum absorption was obtained at 475 mμ, which is the absorption maximum of free astaxanthin in acetone. In addition, the absorption curve resembled the curve for astaxanthin.

For further comparison, four skinless redfish fillets taken from two normal-colored redfish were minced, sampled, and extracted with acetone in the same manner that was used with the red-fleshed fillets. Absorption as measured on the Beckman spectrophotometer was negligible in the range 400 to 700 mμ. This finding indicates that astaxanthin was not present in these normal-colored redfish fillets.

Chemical analyses.--Chemical analyses showed red fillets to have a higher fat content than fillets of normal color. Other differences in the chemical composition of the red and the white fillets were not great. A large number of specimens would be required in order that comparative chemical analyses might be used to prove statistically any real differences. Judging from the reports of various Canadian fisheries inspectors, redfish with red flesh are uncommon.

Occurrence in other groundfish.--Two haddock, Melanogrammus aeglefinus, with pale red flesh

(over)

ABSTRACTER: Martin Heerdt

2.1474 DESCRIPTION OF THE FISHERY WITH LARGE TRAPS

Schlieker, E.
Deutsche Fischerei Zeitung 4, No. 5, p. 129 (May 1957) (In German)
World Fisheries Abstracts 9, 17-18 (May-June 1958)

Fishing gear consisting of large traps is described and their capacity is not yet fully utilized in E. Germany. Off the Baltic shore, fishing for herring and eels with large traps has become the most important fishing method. Two main types of large traps are to be distinguished on the coast: herring and eel traps. The former consists of a large entrapping chamber with one inner valve net. The latter has 2 entrapping chambers with one inner valve net each, but the total gear is not larger than the herring trap. Their entrapping chambers are 6 m. wide only (19.7 ft.) as compared with 9 m. (29.7 ft.) of the herring traps. The bottom of the entrapping chamber consists of webbing. The traps used in fresh water fisheries are less uniform than those used on the coast and very little experience has been gained with large traps. It would be necessary to improve their efficiency and to increase the period they can be used; two new types of large traps with 2 entrapping chambers are suggested. The requirements of construction material are reduced as well as the design of a technically favorable shape is aimed at.

The recently described large traps, to be used especially for eel and pike fishing in lakes, are a combination of an entrapping chamber and fyke net. Thus, the catch can easily be unloaded (see Fig. 1 over, omitted). The guiding screen does not lead to the valve net, so as to prevent the returning fish from escaping. The measurements of the gear depend on the size and depth of the water. The second large trap described consists of 2 entrapping chambers (see Fig. 2 over, omitted). It was designed in such a way that the anterior chamber guides the fish into the rear chamber and the anterior chamber, therefore, narrows gradually towards the second chamber. The bottom area of

(over)

ABSTRACTER: A von Brandt

AUSTRALIAN SHARK FISHERY

RED FLESH IN SEBASTES MARINUS

PATHOGENIC BACTERIA IN PRECOOKED FOODS

TRAP FISHING

2.00 (Cross Reference: 1.4)

were seen in a fresh-fish plant in Fortune in 1955. These haddock, which apparently came from the St. Pierre Bank, had pigmented flesh resembling the color of salmon. During the season 1951-1952, a cod with flesh that was salmon pink in color was landed at Ramea on the south coast of Newfoundland. This fish, caught in inshore waters, was about 20 inches long and had a brownish skin. The skin color did not appear to have any relation to the flesh color.

Discussion.--The unusual occurrence of astaxanthin in fillets of redfish, haddock, and cod may be a pathological condition. Burkhardt and co-workers (1934) considered that the presence of astaxanthin in the red body oils of whales is indicative of a pathological condition. Fish derive astaxanthin from their diet and not by synthesizing it. Sources of astaxanthin in the diets of fish include euphausiids, copepods, and shrimp. Euphausiids make up a large part of the diet of redfish in the Newfoundland area. In the larger redfish, euphausiids presumably provide the chief source of the astaxanthin pigment of the redfish skin. Since astaxanthin ordinarily occurs in the skin of redfish, the absorption of astaxanthin from the viscera of the fish in large quantities or in a breakdown in the excretion of the astaxanthin by the fish could lead to a condition whereby an excess of astaxanthin might be deposited in the muscle tissue.

Analyses of red and normal redfish fillets

	Composite sample from two red fillets	Composite sample from four normal white fillets	
	g.	g.	
Solids	24.9	20.6	per 100 g. wet muscle
Crude protein	18.3	17.4	per 100 g. wet muscle
Fat (Ethyl ether extract)	4.8	2.5	per 100 g. wet muscle

2.1474

the second chamber is 18 percent larger than that of the first. Both the traps are set by means of stakes. To make setting easier, a pattern is formed by ropes with floats on the water, before the gear is set, showing the shape of the actual trap without the anterior gear. After this pattern the poles are driven into the bottom. When setting the trap off the coast, the gear has to be anchored to make the trap more stable. The traps should be made of "Perlon," either continuous or monofilament.

1.70

14 SW6 monel wire. The snoods are 3 fathoms apart. Flags are coupled to the buoy lines. The usual number of hooks shot at one time is approximately 2,000. Almost any fresh fish may be used as bait, and salt fish also is usable.

The line hauler is driven by a V-belt from the propulsion motor or by a separate diesel motor. Hydraulic haulers have recently become available. The line comes from the water over removable rollers that are fitted to the rail of the boat. Speed of hauling runs from 300 to 400 hooks per hour, depending on the number of fish caught.

The crew usually consists of three men, the skipper and two other hands. The skipper maneuvers the boat, gaffs and unhooks the fish, and cuts the heads off the fish to bleed them. One man attends to the line hauler, and the third man starts to clean fish or assist wherever he may be required.

Sharks usually favor rough coral and shell-type ground or around the edges of rock reefs, usually where the tides run strong. They may be found on almost any bottom except mud.

2.05

initially isolated by inoculating selenite broth with the yeast-extract-veal-infusion enrichment culture previously described, incubating the broth at 37° C. for 18 hours and streaking from the broth onto plates of bismuth sulphite agar and SS agar.

Selections of 31 of the more heavily contaminated foods were heated according to the manufacturer's recommendations, and the surviving bacterial populations were determined by the same series of tests as described above.

Results.--Escherichia coli were found in 54 frozen foods in numbers ranging up to 130,000 per gram. Enterococci were present in 60 frozen foods in numbers ranging up to 140,000 per gram. Organisms representative of the Bethesda-Ballerup group of Salmonella were found in 14 frozen foods, whereas organisms representative of the Providence group were found in only two foods. Representatives of the Arizona group of Salmonella were not found. Coagulase-positive staphylococci were found in 21 foods ranging in numbers up to 70,000 per gram. Staphylococci and enterococci each survived heating at 400 to 450° F. for 20 to 40 minutes as recommended in 10 percent of the samples. Heating reduced the numbers of bacteria in the various foods, as measured by standard plate counts, from 57.5 to 100 percent with an average reduction of 99.9 percent. The maximum numbers of bacteria in the various test categories to survive heating and their respective initial numbers as obtained from identical samples of the foods were as follows: standard plate count, 85,000 and 200,000 per gram; enterococci, 1,900 and 6,000 per gram; and staphylococci, 150 and 1,200 per gram. Escherichia coli and other members of the Enterobacteriaceae failed to survive the heating process even though a maximum initial value of 130,000 per gram had been present.

Discussion.--The above data suggest that many of the foods examined contained sufficiently large numbers of bacteria to indicate a possibility of deterioration in quality. These numbers of bacteria established an objectionably high degree of contamination from fecal and nasopharyngeal or suppurative sources. This amount of contamination might be sufficient in some instances to indicate a risk of enteric infection or staphylococcal food poisoning if the foods did not receive the recommended amount of cooking or if the foods were not stored at the proper temperature before or after they were purchased for use in the home.

2.1474 LATH-SPACING IN LOBSTER TRAPS

Templeman, W.
Progress Reports of the Atlantic Coast Stations, Fisheries Research Board of Canada, No. 69, 22-27 (May 1958)

The author reviews experiments carried out to determine the effect of lath spacing of lobster pots on the size of the lobsters retained. In 1890, a Norwegian named Adolph Nielsen placed lobsters ranging from 6 to 10 inches in length in experimental traps in shallow water and found that: (1) a 10-inch lobster could escape if the undermost laths were spaced 2-1/4 inches apart, but not if they were 2-1/8 inches apart; (2) a 9-inch lobster could escape if the laths were 2-1/8 inches apart, but not if they were 2 inches apart; and (3) an 8-inch lobster could escape if the laths were 1-7/8 inches apart but not if they were 1-3/4 inches apart.

The author's experiments at Port au Port in St. Georges Bay in 1938 revealed, contrary to the beliefs of commercial lobster fishermen, that traps with a 1-3/4-inch or legal spacing between the lower laths retained less than 20 percent as many illegal size lobsters (below 9 inches) as the narrow spaced (1-1/3-inch) traps. Further, that the legal traps caught more legal lobsters (over 9 inches) than the traps with smaller lath spacing.

Between 1943 and 1946, D. G. Wilder made comparisons between the existing commercial traps with a lath spacing of 1 inch or less and similar traps with a lath spacing of 1-1/4 inches, all of which were set in the southern Gulf of St. Lawrence where the legal minimum length is 7 inches. The experimental traps retained only 40 percent as many illegal lobsters (below 7 inches) and caught more legal lobsters than the traps with wider lath spaces. Similarly, in areas of southern Nova Scotia and New Brunswick, traps with 1-3/4-inch lath spacing caught only 25 percent as many illegal lobsters (below approximately 9 inches) and more legal lobsters than traps with 1-1/4-inch lath spacing.

(over)

ABSTRACTER: Frederick Wathne

3.12 THE KEEPING TIME OF WRAPPED FILLETS TREATED WITH AN ANTIBIOTIC

Castell, C. H. (Fisheries Technological Station, Halifax, Nova Scotia)
Canadian Fisherman 45, 6 (July 1958)

In a previous issue of Canadian Fisherman, an article entitled "Should we prewrap fresh fillets in consumer-size packets?" pointed out the advantages and disadvantages of wrapping fillets in transparent, air-tight wrappers. From the standpoint of sanitation and customer appeal, there is an advantage to the wrappers. It was shown, however, that unwrapped fillets stored on ice had a longer keeping time than did those in air-tight wrappers.

The article also stated that "in actual practice the keeping time of the wrapped fillets could be easily extended by the use of a suitable antibiotic or some other acceptable preservative." The question is: by how many days could the keeping time be extended?

Experimental.--From a plant that normally used the antibiotic chlortetracycline (CTC) as a preservative for their fresh fillets were obtained 100 fresh untreated haddock fillets and 100 similar fillets that had been dipped in a solution containing approximately 10 p.p.m. CTC.

Half of these fillets were stored unwrapped in ice, and the other half were wrapped in waxed paper and stored in watertight aluminum containers that were buried in ice. In both cases the temperature of the fillets remained fairly constant at 32° F. throughout the test period. Periodically a number of fillets were withdrawn from each lot, carefully examined for indications of spoilage, and tested for content of trimethylamine.

Results of tests.--The results are summarized in the accompanying tables. The wrapped, untreated fillets showed the first signs of spoilage at 5 days and were inedible at 10 days. The wrapped, CTC-treated fillets began to spoil at 8 or 9 days and were approaching the inedible state at 12 days. The untreated, unwrapped fillets on ice were also quite acceptable up to 9 days but had only slightly sour odors at 10 days. The CTC-treated fillets stored in ice were edible at 12 days.

(over)

ABSTRACTER; Kathryn L. Osterhaug

2.3 THE EFFECT OF WASHING ON THE DARKENING OF COLD-STORED SHRIMP

Asakawa, S.
Refrigeration, Japan 31, No. 350, p. 23 (Dec. 1956) (In Japanese)
World Fisheries Abstracts 9, 25-26 (May-June 1958)

The prevention of darkening in ice of stored shrimp has been studied chemically by several groups of workers in recent years.

The present investigation was undertaken to show clearly the effect of washing these cold stored shrimps with fresh water. This treatment, if carried out efficiently, often cured the trouble.

The author washed the fresh shrimps, Metapenaeopus barbatus (de Haan), M. acclivis (Rathbun), and Trachypenaeus curvirostris (Stimpson), caught in the inland sea of Japan, Bingo Nada, by the following methods: (1) Static water method: the sample of shrimps was placed in a given volume of water for a given time. (2) Repeated washing method: the sample of shrimps was washed in a quarter of the above volume of water for a quarter of the time, but treated 4 times. The total volume of water and the time were thus the same as in the static water method. (3) Running water method: the sample of shrimps was washed with running water for the same time.

The washed shrimps were then cold-stored for 30 days and observations made on the development of the darkening. The results obtained show that the repeated washing method is the best. On the basis of these results and other experience, it seemed reasonable to assume that tyrosinase, which is believed to cause the darkening in the shrimp, exists especially under the front shell, in the region of the gill cavity, and is extracted easily. But in the gill cavity the running water cannot

(over)

Reprinted in whole

3.2383 PACKAGING EFFECTS ON FROZEN FISH PALATABILITY ARE STUDIED BY MINNESOTA RESEARCHERS

Winter, J. D. and Trantanella, Shirley (University of Minnesota, Institute of Agriculture, St. Paul)
Quick Frozen Foods 20, 81-83, 159 (July 1958)

The palatability and general acceptability of frozen foods may be affected significantly by the packaging materials used.

The study reported here was designed to compare the palatability of frozen lake herring (Leucichthys artedi) fillets packaged in unmodified polyethylene film with the palatability of fillets packed in polyethylene modified by the inclusion of an antioxidant. The antioxidant chosen was acceptable to the U. S. Food and Drug Administration at the concentration used.

Materials and methods.--The herring used were netted on the same vessel at the same time in 15 fathoms of water 9 miles east of Duluth harbor in Lake Superior. These herring were of the type known locally as "bottom" or "green back" and are considered locally to hold up better during handling than do the "surface" or "blue back" type. Their oil content is approximately 1.48 percent.

The fish were landed within 3 hours after the nets were pulled, transferred to boxes, and held over night at ambient temperatures of 30° to 40° F. The internal temperature of the fish remained at 37° to 39° F.

The next morning the fish were scaled and washed by machine, filleted by hand, washed again, and packed with ice into metal containers of 20-pound capacity. These containers were shipped to St. Paul where the fillets were packaged and frozen the next day.

The following packaging materials were used, all in bag form except the aluminum foil: (Lot H) polyethylene 0.0015-inches formulated with antioxidant (0.03 percent Armid and 0.02 percent DBPC), (Lot J) polyethylene 0.003 inches formulated with antioxidant, (Lot M) unmodified polyethylene 0.0015 inches, (Lot N) unmodified polyethylene 0.003 inches, and (Lot T) aluminum locker foil 0.0015 inches.

(over)

ABSTRACTER: Kathryn L. Osterhaug

2.3

extract it, whereas repeated washing gives adequate extraction, because the dissolved enzyme is removed from the gill cavity as often as the water is changed.

In view of the above observations, a necessary step for the prevention of darkening in shrimp is that the washing water must be removed thoroughly from the shrimp shell cavity by some means.

2.1474

Lath-spacing regulations in effect in Newfoundland since 1893 have produced no unfavorable effects on the catch of legal-size lobsters and have resulted in the liberation of more than 80 percent of the short lobsters.

Lath-spacing regulations for Quebec and the Maritimes Provinces became effective during May 1949 and were revoked during February 1955.

"The fishermen's honest objections cannot in any long range view be shown to be well enough founded and important enough to offset the good effects of the regulation requiring wide spacing of laths, but they are undoubtedly well fixed in their minds and will have to be reasoned away."

The author feels that in the Maritime Provinces there are very likely large areas where the regulation would be supported by the fishermen, and once successfully operative in these areas, by education and example it would be possible to gradually increase the amount of coastline covered by lath-spacing regulations.

3.2383

Two butterfly fillets, the edible portion of two fish, were placed in each bag and heat-sealed, as little air as possible being left in the bag. The samples in aluminum foil were packaged by the customary freezer-wrap method.

The packages of fish were placed one layer deep on the refrigerated shelves of upright-type home freezers that operated at approximately -10° F. and were frozen.

In order to provide uniform storage conditions, wooden blocks were placed at the ends of 11-by-17-inch aluminum trays, and the frozen samples of lake herring were arranged on the trays approximately 1 inch apart. The trays were stacked to a height of about 9 inches, including an empty aluminum tray on the top and the bottom of each stack.

Duplicate samples were stored at two different temperatures--at 0° and at -15° F. The samples were stored for 4 and for 6½ months.

Results.--The samples were judged for palatability by a panel of five qualified judges.

The polyethylene films were found to provide good product protection for a storage period of 4 months. No statistically significant difference could be demonstrated between the various packaging materials during the 4-month storage period at either temperature. The palatability of the samples in polyethylene film remained commercially acceptable for 6½ months at both temperatures of storage, but the scores were significantly lower than were the scores of the samples packaged in aluminum foil.

There was no significant difference in palatability scores that could be attributed either to the thickness of the polyethylene film or to the antioxidant that had been incorporated into the 0.0015-inch film. There was, however, a small difference in favor of the antioxidant treatment when the 0.003-inch film was used.

After 6½ months of storage, the palatability scores of all samples stored at -15° F. were significantly better than were those of samples stored at 0° F.

3.12

Table 1.-- The development of off-odors in wrapped and unwrapped haddock fillets. Half the fillets were dipped in an antibiotic preservative at the fish plant (the dip contained 10 p.p.m. chlortetracycline, sold under the trade name of "Acronize"), and the remainder were left untreated.

Days in storage	Fillet odor			
	Unwrapped fillets on ice		Wrapped fillets in cold storage	
	Acronized	Untreated	Acronized	Untreated
3	No off-odors	No off-odors	No off-odors	No off-odors
4	No off-odors	No off-odors	No off-odors	No off-odors
5	No off-odors	No off-odors	No off-odors	Slightly sour
7	No off-odors	No off-odors	None to slight off-odors	Sour
9	No off-odors	No off-odors	Slightly sour	Putrid
12	No off-odors	Slightly sour	Slightly sour	Putrid

Table 2.--Trimethylamine is one of the spoilage products that accumulate as fish muscle deteriorates, and is frequently used as a measure of the amount of spoilage that has taken place in sea fish such as cod or haddock.

Days in storage	Trimethylamine values*			
	Unwrapped fillets		Wrapped fillets	
	Acronized	Untreated	Acronized	Untreated
0				
0	0.18	0.15	0.20	0.18
3	0.22	0.38	0.30	0.70
5	0.20	0.50	0.45	3.20
7	0.20	0.52	0.48	11.70
9	0.21	0.61	1.74	15.54
10	0.28	1.29	1.20	15.13
12	0.65	2.97	2.04	15.64

* Mgm. of trimethylamine nitrogen per 100 g. of fillets.

3.239 THE FREEZING OF FISH--FAILURE AND SUCCESS

Jackson, F. Slater (McGill University, Montreal)
Contributions to Canadian Biology 1, No. 10-18, 299-302 (1923)

Hake that have been frozen commercially in air are plump and attractive,but they lose liquid when thawed,and the flesh becomes permeated by cavities that are visible to the eye. A piece of thawed hake flesh can be squeezed to a small volume. When the pressure is released, it regains its original size--like a sponge. This frozen-thawed spongy flesh tends to be both tough and tasteless.

In one experiment, fresh hake were frozen in a mixture of ice and salt and placed in cold storage. Two months later the hake were in excellent condition and, on being thawed, were not spongy. This experience indicates that hake can be satisfactorily frozen.

In explaining these results, the author hypothecated that slow freezing permits the formation of large ice crystals from the watery substances of the muscle. These crystals rupture the fibers and so permit savory fluids to escape with the juice when the fish is thawed. Also, the formation of the ice crystals separates so much water permanently from the flesh that only a solid, tough network of material remains. Thus, the tough, spongy, and tasteless character of the flesh of slowly frozen hake is explained.

To ascertain just what changes do take place in fish muscle as a result of freezing, the author made a microscopic examination (illustrated by 7 excellent figures, omitted) of fish muscle from fresh fish and from fish frozen in air, in brine, and with ethyl chloride.

Fresh muscle, when cut crosswise, presented a fine, even grain. When the muscle was cut parallel to the fibers, each fiber was found to be enclosed by a delicate membrane along which the

(over)

ABSTRACTER: F. Bruce Sanford

3.2496 THE FREEZING AND COLD STORAGE OF MUSSELS

Banks, A. and House, C. T. (Torry Research Station, Aberdeen, Scotland)
Modern Refrigeration 61, 686-688 (June 1958)

Results of experiments indicate that if the proper conditions of cooking, freezing, and cold storage are chosen, frozen cooked mussel meats can be stored successfully for 8 to 9 months.

Experimental.-- Three lots of mussels were tested: Lot 1 comprised uncleansed mussels harvested during the middle of April 1956, Lot 2 comprised cleansed mussels harvested during early February 1957, and Lot 3 comprised cleansed mussels harvested about the middle of March 1957. The mussels were sent to Aberdeen, Scotland, from Conway in wet sacks by passenger train and arrived in good live condition. The mussels were encrusted heavily with barnacles.

The mussels were cooked to facilitate their removal from the shell. An effort was made to avoid overcooking the mussel meats because overcooking causes excessive shrinkage and is reported to cause the meats to become tough in texture. Two methods of cooking were tried: (a) Some of the mussels were cooked in a retort at 5 pounds pressure. Of these, a portion were cooled quickly by being sprayed with tap water, whereas the remainder were allowed to cool in the air. (b) Further samples of mussels were brought to the boil in fresh tap water and in 2.5-percent salt solution and then boiled for two minutes. The cooled meats were separated from the shell with particular care being taken to remove the byssus thread or "beard," which is attached firmly to the center of each meat.

The yield of cooked meats from the mussels that were harvested in April was 7.7 percent, whereas the yield from the mussels harvested in February was 11.8 percent.

(over)

ABSTRACTER: Kathryn L. Osterhaug

3.2495 MEASUREMENT OF TOUGHNESS IN COLD-STORED FISH

Love, R. M. (Torry Research Station, Aberdeen, Scotland)
Nature 182, 108-109 (July 12, 1958)

Introduction.--According to Luijpen (1957), the proportion of fish muscle protein that would dissolve in a 5-percent solution of sodium chloride was not correlated with the development of toughness during storage at or below -20° C. This finding was of considerable significance because it implied that the soluble protein nitrogen, which is usually expressed as a percentage of the total protein nitrogen, can not be used as an objective standard for the quality of frozen fish. Future investigations into the freezing and storage of fish probably will require a direct estimation of toughness as a measure of changes in quality. Measurement of toughness with the aid of a taste panel is time consuming, inaccurate, and limited to a few samples at a sitting. Penetrometers, shear apparati, and other machines for estimating the toughness of beef muscle usually cannot be adapted to fish because fish fibers are extremely short and interspersed with sheets of connective tissue, which are tougher than the muscle itself.

Method for measuring toughness.-- A method recently devised for measuring toughness that requires only a small piece of fish muscle was tried,using uncooked cod (Gadus callarias) muscle. Two Swann-Morton No. 24 scapel blades were mounted 3 mm. apart and parallel in a single handle. The blades were sunk by a gentle sawing action into a wide myotome or muscle segment on the bone side of a cod fillet at right angles to the long axis in a block of muscle lying immediately dorsal to the lateral line. The double scapel then was withdrawn with a slight twisting movement so that a piece of muscle containing fibers of a uniform length became detached from the fish. This piece of muscle was removed from between the blades and freed from traces of connective tissue.

Assay of muscle sample.-- Two samples of these muscle fibers each weighing 200 ± 5 mgm. were

(over)

ABSTRACTER: Martin Heerdt

3.33 THE APPLICATION OF THERMAL DATA TO THE CALCULATION OF STERILIZING TIMES FOR CANNED FISH

Cooper, D. LeB. (Atlantic Fisheries Experimental Station)
Journal of the Biological Board of Canada 3, No. 2, 100-107 (January-March 1937)

The author used (1) data on the heat lethality of certain organisms, (2) experimentally determined mean values of K, the diffusivity, and (3) the equation for the flow of heat in a finite cylinder of radius a and length 2L, $t = \frac{2.302}{K} \frac{1}{\left(\frac{2.40}{a}\right)^2 + \frac{\pi^2}{4L^2}} \log 6.42 \frac{(T_r - T_o)}{\pi (T_r - T)}$, to calculate sterilization times for canned fish. The symbol t in the equation represents the time in seconds for the center of the can, originally at a temperature of T° C., to reach a temperature of T_o° C. in a retort at a temperature of T_r° C. K is the diffusivity in centimeter, gram, seconds units.

The use of this equation to estimate sterilization time depends primarily on the degree to which the bacterial death rate is affected by time-temperature relationships brought about by variations in K. The author measured the rate of heat penetration in various products under different conditions and calculated K by substitution in the foregoing equation. The mean values of K were combined with the lethality curve for the organism Bacillus botulinus (Weiss 1921) to calculate sterilization times for other sets of conditions. These were then compared with the actual times as calculated from the experimental data on heat penetration.

Each can of fish was brought to a uniform temperature in an external bath, then placed in the retort, and processed. Temperature readings were taken by means of protected thermocouples at various time intervals, and a direct graph was plotted. The upper section of this graph was

(over)

ABSTRACTER: Martin Heerdt

FAST VERSUS SLOW FREEZING

MEASUREMENT OF FISH TOUGHNESS

FREEZING MUSSELS

STERILIZATION OF CANNED FISH

3.2495

added to 20 ml. of approximately 1-percent formaldehyde solution cooled to less than 10° C. in the metal cup of a Marsh-Snow (1950) homogenizer that had been fitted with a baffle plate above the paddle blade to prevent frothing. The homogenizer, maintained at less than 20° C., was operated for 20 seconds at about 2,200 r.p.m., the resulting homogenate was poured with minimum delay into a ½-cm. optical cell, and the optical density of the homogenate was read immediately in a Hilger Biochem absorptiometer with a 430-mμ filter and with incident light of a suitable wavelength.

Results.--Fresh codfish muscle yielded fibers that were completely broken up in the homogenizer to form an optically dense soup. Frozen codfish muscle yielded fibers that were only partially broken up in the homogenizer. Frozen codfish that had been held for a long time in storage yielded only intact fibers suspended in clear liquid; therefore, the amount of muscle-fiber disintegration was found to depend upon how long the fish had been held in storage. The optical density of the soup decreased regularly in keeping with the number of intact fibers that were present.

Microscopic examination of soups from fish of intermediate toughness showed that the majority of the fibers were either completely dispersed as fine fibrils or completely intact. A few fibers appeared to have been split longitudinally. This finding appears to indicate that toughness may be related to the cell envelope, the destruction of which releases all of the fibers. This would not occur if the cells as a unit were increasing in toughness. Tabulated data are presented to show a decrease in the optical density of soups obtained at intervals over a period of 15 weeks from frozen cod fillets held at -14° C. Freezing itself appears also to increase toughness.

Conclusions.--The author believes that he has developed a satisfactory method for assessing changes in the texture of fish immediately after freezing and during frozen storage. Fish size and other factors would only affect the interpretation of the results and not their validity.

3.33 (Cross Reference: 0.5)

rectified, and K was determined from this section for a number of different products packed in No. 1, standard cans.

The calculated error in the determination of the value of K for each product in table 1 (omitted) is approximately 15 percent. The only significant differences are between those cans with initial temperatures from 11.2° to 25° C. and those with initial temperatures from 40° to 44° C. As the initial temperature was increased, the value of K increased. The utility of the method is limited by the extent of the range in retorting time, owing to differences in the value of K. Retorting time depends on other factors such as the time-lethality curve of the organism.

If lethality is defined as the reciprocal of the times necessary at different temperatures to kill all of the individual organisms in a suspension of a given species, lethality and heat penetration data may be used to calculate sterilization times (Bigelow 1920). Figure 4 (omitted) shows one lethality curve and two heat-penetration curves for the organism Bacillus botulinus. The two latter curves give values of 73 and 82 minutes, respectively, for complete sterilization of a one-pound tall can retorted at 115° C. The value of K was assumed to have changed from 0.0016 (82 minutes) to 0.0014 (73 minutes).

Differences between processing times calculated from the equation and processing times determined experimentally at 115° C. for one-quarter, one-half, and one-pound flat cans were, respectively, 43 and 41; 63 and 58; and 73 and 66 minutes. These cans were processed under ideal conditions in which the retort reached 115° C. in 30 seconds and cooled instantaneously. In commercial practice, a lag of 10 or more minutes is not uncommon. Temperatures are not maintained with precision, bacterial contamination may vary from day to day, and the rate of cooling is not controlled. Therefore, the indicated differences are not significant, and the two mean values of K may be used for the calculation of sterilization times for cans of solidly packed fish.

3.239

nuclei were scattered. Fine cross markings of the fibers also were observed.

The muscle fibers in fish frozen in air were largely destroyed and widely separated by the large ice crystals that formed in and between them. On being thawed, the muscles had a loose, spongy appearance. The muscle fiber was so altered as to fail to show the fine cross markings.

Fish frozen in brine presented an appearance more like that of fresh fish, since the fibers were altered very little. Only a few of the fibers showed any space inside them, and these spaces were small.

The author states that the more rapid the freezing, the smaller are the ice crystals. Since such crystals are so minute, they cause little change in the muscle fiber. That is, they are not large enough to rupture the fiber, but are formed between the very small fibrils of which the fiber is composed.

Freezing experiments were made with ethyl chloride in order to demonstrate further that the more rapid the freezing, the less change occurs in the muscle. The author found that even under the microscope, ethyl chloride-frozen muscle hardly could be distinguished from fresh muscle.

3.2496

The meats of the cooked mussels, particularly those of the uncleansed mussels, contained a considerable amount of sand. All of the meats, therefore, were rinsed three times either with water or with a 2.5-percent salt solution.

Methods of freezing used were (1) some of the mussels were frozen in waxed cartons that measured 9 inches by 3¾ inches by 1 inch and held approximately 12 ounces; (2) some were frozen in blocks in metal trays that measured 7 inches by 6 inches by 1 inch and weighed approximately 1 pound; and (3) others were frozen in small tubs that measured 2-5/8 inches in height, 2 inches in diameter at the bottom, and 2½ inches in diameter at the top and held approximately 3 ounces. All of the packaged mussels were frozen in an air blast at -20° F. The packages were frozen to -8° F. in approximately 50 minutes, and the tubs were frozen to the same temperature in 80 minutes. The blocks of frozen mussel were glazed and then wrapped in grease-proof paper and aluminum foil. The mussels frozen in cartons and tubs were stored without further wrapping.

A number of tests were made of the effect of the various treatments to which the mussels had been subjected before freezing upon their texture after frozen storage. The mussels were examined a few days after freezing and periodically during storage that extended to a total of 9 months. Storage temperatures used were -7° and -20° F.

The mussels to be examined were submitted to a panel of 6 or 7 persons for their judgment of flavor and texture.

Conclusions.--In general, the methods of cooking and treatment had little adverse effect on the texture of the thawed mussels. After 3 months of storage, the mussels held at -7° F. had a slightly tougher texture than did those stored at -20° F.

Mussels cooked in weak salt solutions developed slight off-flavors after long storage, and untreated samples, therefore, were preferred. There was a slight preference for the mussels that had been cooked in steam and cooled quickly by being sprayed with tap water.

3.5 STUDIES ON SALT FISH X. EFFECT OF DISINFECTANTS AND PRESERVATIVES ON RED HALOPHILIC BACTERIA

Hess, Ernest and Gibbons, N. E. (Atlantic Fisheries Experimental Station)
Journal of the Fisheries Research Board of Canada 6, No. 1, 17-23 (December 1942)

The authors studied the action of commercial disinfectants used to sterilize salt-fish plants and fishing vessels against red halophilic bacteria. To determine the effectiveness of lye (commercial sodium hydroxide), 1 milliliter quantities of heavily contaminated brine were added to 10 ml. of each of a number of lye solutions. Samples withdrawn at 1-minute intervals were inoculated into skim-milk salt-agar plates. Survival after incubation at 37° C. for 30 days showed that 2-minute exposure in a 2-percent solution of lye or 1-minute exposure in a chlorine solution containing 5,000 p.p.m. of available chlorine was effective in killing the red halophilic bacteria.

Emulsions containing four strains of red halophiles were spread on sterile cover glasses and allowed to dry. These cover glasses were then dropped into various formaldehyde solutions, removed at regular intervals, and allowed to drain. The emulsion side of the cover glass was then pressed against a skim-milk salt-agar plate, and the latter was incubated at 37° C. Growth did not take place from red halophilic emulsions that had been held for 1 minute in a 1,000 p.p.m. formaldehyde solution in the absence of protein. Fumigation, (10 oz. formaldehyde per 1,000 cu. ft. of space) killed all red halophiles directly exposed but did not affect those protected by cotton batting or by thin wooden boards. Fumigation with sulphurous acid (5 pounds of sublimed sulphur burned per 1,000 cu. ft. of area) killed all red halophiles directly exposed and, in some instances, penetrated ½-inch-thick wooden boards.

Preservatives mixed with curing salts also were used to inhibit the growth of red halophiles on contaminated fish. A mixture containing 3 percent sodium acid phosphate and 0.25 percent sodium benzoate was found to be most effective for inhibiting the growth of both red halophilic bacteria and

(over)

 ABSTRACTER: Martin Heerdt

3.8 RESEARCHES ON THE WEIGHT LOSSES OF ANCHOVIES DURING STORAGE

Metzner, H. and Ulex, G. J.
Deutsche Lebensmittel-Rundschau 53, No. 2, p. 38 (Feb. 1957) (Munich, W. Germany) (In German)
World Fisheries Abstracts 9, 35-36 (May-June 1958)

The weight loss during storage of preserved fisheries products is a great problem, particularly with anchovies which are cured with salt and sugar. The weight losses depend on the composition of the sauce, storage temperature, etc. In industry, the initial weight of fish is estimated by weighing the can with contents as against the can with the same amount of sauce. In the present experiments, 75 g. (2-5/8 oz.) of drained appetitsild (marinated herring) or 200 g. (7-1/16 oz.) anchovies or other fish products were packed in cans with the same amounts of sauce and their weight losses studied during storage. The fish weights were determined after draining for exactly 10 min. The weight losses were studied during storage at cold temperature, i.e., about 4° C. (39.2° F.) and warm temperature, i.e., about 25° C. (77° F.). The results are shown in a table overleaf. The weight loss is influenced by the amount of sugar in curing as well as storage temperature, greatest losses occurring at higher temperatures. In 25 weeks, there was a weight loss of 40 percent in the case of appetitsild in cans. It is suggested, that before releasing the product for sale, the input weight of the fish and the date should be mentioned on the package.

See table, over.

(over)

 ABSTRACTER: G. N. Subba Rao

3.5 ARTIFICIAL DRYING OF SALT FISH BY THERMOCOUPLE CONTROL

Legendre, R. (Fisheries Technological Station, Grande-Riviere, Quebec)
Journal of the Fisheries Research Board of Canada 15, 543-554 (July 1958)

Introduction.--The author has devised a new method of control to provide for ideal temperatures and relative humidities in artificial dryers for salt fish. A thermocouple inserted in the flesh near the surface of the salt fish in the dryer is used to regulate the temperature of the circulating air.

Experimental.--Drying studies were carried out in an experimental dryer having a capacity of 400 pounds of salt fish and equipped with a thermocouple system of control. External dehumidification of the air was not used, whereas steam humidification was used as needed in combination with recirculation of the dryer air. An air velocity of 350 lineal feet per minute was maintained throughout all experiments.

In each experiment, the dryer was filled with fish of uniform medium size and that had been salted previously by the conventional procedure for each particular product, including both light and heavy salted fish. Care was used to select fish of identical initial moisture content for each experiment because the drying rate is greatly influenced by this factor. The average moisture content of the lightly salted fish used in this study was 75.6 percent water on a wet basis or 310 percent water on a dry basis. The average moisture content of heavily salted fish used in these studies was 60 percent water on a wet basis or 150 percent water on a dry basis. At each stage of drying the loss in weight was followed by determining the weight of five fish on a torsion balance. Moisture content values reported in this study refer to fish on a dry basis or pounds of water per 100 pounds of dry fish.

Atmospheric conditions.--In order to obtain acceptable, artificially dried salt fish with the conventional control system, the temperature inside the dryer should be maintained at 80° F. and the relative humidity at 55 percent. This is possible when the outside temperature is below 80° F. and the dew point is below 55° F. Drying can still be carried out at dew points above 55° F. but at a slower

(over)

 ABSTRACTER: Martin Heerdt

4.60 ENZYMATIC OXYGEN REMOVAL FROM PACKAGED FOODS

Scott, Don (Fermco Laboratories Inc., Chicago, Illinois)
Food Technology 12, 7-8, 11, 13-17 (July 1958)

Introduction.--The presence of oxygen is one of the most widespread deteriorative factors of concern to present-day food technologists. Fortunately, both synthetic and naturally formed chemical antioxidants are available in addition to physical means for reducing the oxygen content of the container. Antioxidants may be classified as to their mode of action as follows: (1) phenolic antioxidants or chain breakers such as BHA, BHT, and NDGA that are ordinarily used with fats and oils; (2) sequestrants such as citric and ascorbic acid that are used with fats and oils; (3) reducing agents such as ascorbic acid that are used in aqueous products; and (4) enzymatic oxygen scavengers that are used with fats, oils, and aqueous and dry products.

Effect of antioxidants.--Phenolic antioxidants or phenolics function by combining with hydroperoxides that are formed in the early stages of oxidative rancidity. In so doing, they break the chain of the reaction and retard the rate of oxidation. Phenolics cannot begin to function until rancidity has occurred to a slight degree. In addition, phenolics will not halt oxidative rancidity if it has progressed to a substantial peroxide value. Phenolics are ineffective against (1) hydrolytic rancidity catalyzed by lipase and (2) enzymatic fat oxidation catalyzed by lipoxidase.

Sequestrants function by binding metal ions such as copper ions that tend to catalyze oxidative rancidity. Sequestrant agents such as citric acid are usually combined with phenolics to obtain a synergistic effect. Sequestrant agents by themselves are relatively ineffective as antioxidants unless the product has been processed in copper equipment and a high metal ion level exists.

Reducing agents such as ascorbic acid function by being readily oxidizable. In theory, they are oxidized by the oxygen present before the food itself is affected. Ascorbic acid is the most widely used reducing agent, and it is effective in preventing the corrosion of the can when used with canned grape soda.

(over)

 ABSTRACTER: Martin Heerdt

DISINFECTING RED HALOPHILIC BACTERIA

THERMOCOUPLE CONTROLS FOR DRYING

STORAGE OF CURED ANCHOVIES

ENZYMATIC ANTIOXIDANT

3.5

rate so that, particularly at dew points between 60 and 65° F., light salted fish is subject to sliming. At dew points above 65° F., drying is impossible.

The thermocouple system of control maintains dryer conditions that permit perfect operation at much higher dew points. If the surface of the fish is still wet, temperature limits are practically nonexistent, and good results can be obtained as long as the dew point does not exceed 72° F. When the surface is dry, the temperature must be below 80° F. and the dew point in the vicinity of 65° F. Drying is still possible, although at a reduced rate, with dew points up to 68° F.

Results and conclusions. -- The thermocouple method of control as proposed by the author for use in mechanical salt fish dryers permits a constant and automatic regulation of temperature and relative humidity. The thermocouple method of control has four advantages over the conventional method of control. (1) If atmospheric conditions are favorable for artificial drying, an increase in the rate of drying is obtained at the beginning of each drying period. (2) The thermocouple method of control permits an increase in relative humidity as soon as the surface of the fish becomes dry; therefore the production of choice quality, lightly, or heavily salted fish is comparatively simple. (3) Only three drying periods are required with lightly salted fish, whereas four drying periods are required if lightly salted fish are dried by the conventional method. The possibilities of over drying the surface or cooking the fish are automatically eliminated. (4) Good results are obtained even with unfavorable atmospheric conditions for drying, and external dehumidifiers are not required. The rate of drying is comparable to that obtained by the conventional method under favorable atmospheric conditions.

4.60

Antioxidants that are essentially specific for oxygen are the enzymatic oxygen scavengers. As used today, these enzymes are applied as a system consisting of glucose, oxidase, and catalase. This enzyme system is derived from a mold grown under conditions similar to those used for the production of antibiotics. Enzymatic oxygen scavengers act catalytically rather than stoichimetrically; therefore, they are effective in trace quantities. As long as glucose is present, they will function until all of the oxygen has been removed. Because of their almost absolute specificity, enzymatic oxygen scavengers do not cause side reactions.

Ideal antioxidant. --According to the author, glucose oxidase-catalase is an ideal antioxidant for increasing the shelf life of sealed packages. With the removal of oxygen as its basis of action, glucose oxidase-catalase, theoretically, should halt oxidative rancidity even if it has already started. In addition, it should prevent the occurrence of oxidation, which has not taken place. Another advantage is its effectiveness against other types of degradations in which oxygen is required such as the regression of oils, lipoxidase degradation, and even the Maillard reaction.

Experimental use has been made of glucose oxidase-catalase as an inner surface coating for packaged cheeses to prevent brown ring formation. Moisture necessary to reactivate the enzymes is picked up from the food, and if necessary, glucose and buffering materials may be incorporated in the surface coating applied to the packaging material prior to use. Glucose oxidase-catalase also has been used commercially as a rapid means of deoxygenizing dry foods in sealed containers to oxygen levels that are below the levels detectable on an Orsat apparatus. Glucose oxidase-catalase will continue to function after the package is sealed until all of the oxygen has been exhausted, provided glucose and buffer are present.

3.5

brown halophilic "Dun" molds. The effectiveness of sodium benzoate was dependent upon the pH or the buffering effect of sodium acid phosphate.

The amount of sodium nitrite dissolved in skim-milk agar media to inhibit the growth of red halophiles was greater than that permitted by pure-food laws in Canada. Growth of red halophiles on contaminated fish could also be prevented by curing the fish with a mixture of solar salt containing 5 percent sodium carbonate (pH 10.0).

Organic acids were added in different concentrations to salt-fish broth or skim-milk salt-agar to determine their effect when the media were inoculated with red halophiles and incubated at 37° C. Citric and lactic acids were found to be more effective in preventing growth than was acetic acid. Propionic acid was found most suitable because it had the least effect on the odor and appearance of the fish muscle. Preservative dips for salt fish that had been contaminated were found to be impractical.

3.8

Losses in Anchovy during storage

Fish pack and date	Fish weight (g.)		Weight losses (%)	
	Cold storage	Warm storage	Cold storage	Warm storage
Appetitsild in cans				
17 May 1954 (initial weight)	40.0	40	--	--
28 May 1954	--	36.8	--	8.0
3 June 1954	38.2	31.4	4.5	21.5
9 Aug. 1954	36.4	29.2	9.0	27.0
21 Oct. 1954	--	25.5	--	36.1
26 Oct. 1954	35.9 (35.3 in another test)	--	10.2	--
17 May 1954 (initial weight)	75.0	75	--	--
28 May 1954	--	68.8	--	8.3
3 June 1954	72.1	64.2	4.0	14.4
9 Aug. 1954	72.8	52.3	3.0	30.3
21 Oct. 1954	--	44.1	--	41.0
26 Oct. 1954	71.0 (69.0 in another test)	--	8.0	--
Anchovies in glass				
25 June 1956 (initial weight)	200.0	200.0	--	--
28 June 1956	186.0	187.0	7.0	6.5
20 Aug. 1956	185.0	173.0	7.5	13.5
10 Sept. 1956	174.0	173.0	13.0	13.5
Fish delicacies in cans				
25 June 1956 (initial weight)	115.0	115.0	--	--
28 June 1956	--	104.5	--	9.3
20 Aug. 1956	105.5	92.0	8.4	20.0
10 Sept. 1956	102.0	88.0	11.4	23.5

6.134 CURTAILMENT OF MALODOR FROM FLAME FISH-MEAL DRIERS

Wright, R. H. and Murray, F. E. (British Columbia Research Council, Vancouver 8, British Columbia)
Canadian Fisherman 45, 11, 13, 15 (July 1958)

The odor from the drier stacks of fish-meal plants is caused by complex and variable mixtures of chemical compounds. It principally consists of ammoniacal odors associated with fish and, to a lesser extent, of the smell of burnt or scorched protein.

Since the odorous amines and products of their mild oxidation, the amine oxides, are readily soluble in water, it appeared that water-scrubbing would offer at least a partial solution to the problem. There was, however, no information available on the chemical nature or water solubility of the compounds that caused the burnt smell. It was decided to experimentally assess the value of water-scrubbing for deodorizing these gases.

Laboratory experiments on odor reduction. -- The initial laboratory experiments were arranged to test water-scrubbing for the absorption of a synthesized meal-drier smell. Ammoniacal and putrid smells were readily scrubbed from the gas stream, but the compounds giving the burnt-protein smell were much less soluble. The burnt smell was partially absorbed, but some of it persisted in the scrubbed gas.

Total deodorization of the drier gases apparently would require a chemical treatment in addition to water-scrubbing. In further experiments, two gaseous oxidants were used in treating the scrubbed gas. Chlorine, added in very small amounts (about 0.3 p.p.m.), reduced the burnt smell to a very low level. Ozone, in equally small quantities, virtually eliminated all objectionable smell in the gas stream. Thorough mixing of the added oxidant with the exhaust gases was essential.

Development of a large-scale scrubber. -- On the basis of the small-scale laboratory results, it was decided that a scrubber should be designed and tested at an operating reduction plant.

(over)

 ABSTRACTER: Kathryn L. Osterhaug

6.14 TESTS SHOW BULK STORAGE OF FISH MEAL SUCCESSFUL

Anonymous
Feedstuffs 30, 78 (August 9, 1958)

Introduction. --The Norwegian State Grain Corporation, Oslo, Norway, has completed an experiment indicating that fish meal can be stored successfully in grain silos. A report on the tests suggested that on the basis of the results, other types of protein feed might be stored in bulk.

Experimental. -- The experiments were carried out to analyze changes in the quality of herring meal bulk-stored in silos, and to compare the quality of herring meal bulk-stored in silos with that stored in paper bags. Feeding tests were made after the storage period to determine the meal quality.

The tests compared herring meal of extra quality, whole meal and whole meal of unground type. The meal of extra quality was stored in a silo for 13 months, the whole meal for 21 months and the unground type for 19 months.

Storage results. --Results of the silo-bag storage comparison indicated that there was a reduced content of dry matter in the meal stored in paper bags. On the other hand, the tendency towards formation of free fatty acids was more dominating in the bulk-stored meal. There was no other difference in the chemical composition of the meal stored by these two methods.

In regard to the physical quality of the meal, bulk storage in a silo seems to be more advantageous because lumping can be avoided more easily by rotation. Therefore, bulk storage and storage in paper bags seem to have largely the same effect on the quality of the herring meal as silo storage; however, a more uniform quality of herring meal is realized.

(over)

 Reprinted in whole

7.89 STUDIES ON THE QUALITY INSPECTION OF FROZEN TUNNY IN FROZEN STATE

Hotani, S.
Journal of the Tokyo University of Fisheries 42, p. 89 (1956)
World Fisheries Abstracts 9, 23-24 (March-April 1958)

A reliable and quick method of estimating the quality of frozen meat has been developed, the method being based on the measurement of internal friction of the meat which increases with decrease in the freshness of meat. The apparatus used (see Fig. 1, omitted) consists of an oscillating vibrator (a) which is a thin and slender steel plate that is plunged into the frozen fish body down to a definite depth. It is made to vibrate at 50 cycles/sec. by means of a magnet (b). It is so designed that its natural frequency is also 50 cycles/sec. and when oscillated as a result of its resonance, the amplitude varies according to internal friction of the meat, making it possible to judge the quality of meat by reading the critical amplitude by means of a micrometer (c). The chuck handle (e) facilitates the insertion of the vibrator into the meat, (d) being a handle for this. For the measurements, the apparatus should be held tightly on the body of frozen tunny by the aid of the grip (f).

The results of tests with this instrument as compared with volatile base measurements are shown in Fig. 2 (omitted). Jellied meat also can be tested by this instrument. Rate and temperature of freezing in the ordinary range does not affect the internal resistance of the frozen meat. The frozen product can be inspected in the corridor or air lock of the cold storage rooms. With frozen tunny, it is advisable to work with the back of the fish. Good results were obtained with frozen yellowfin, swordfish, and albacore.

(over)

 ABSTRACTER: G. N. Subba Rao

7.89 THE EFFECT OF VARIOUS LIGHTING CONDITIONS ON THE EFFICIENCY OF "CANDLING" COD FILLETS FOR DETECTION OF PARASITES

Power, H. E. (Fisheries Technological Station, Halifax, Nova Scotia)
Journal of the Fisheries Research Board of Canada 15, 537-542 (July 1958)

Purpose. --The present experiment was conducted to determine the effects of a number of factors on the efficiency with which cod fillets could be candled and the parasites removed. The factors studied were (1) intensity and color of the light under the fillet (transmitted light) and (2) the intensity of the light falling on the surface of the fillet (incident light).

Experimental. --A small, one-man candling table with a 12- by 24-inch glass top was used in these tests. It was equipped with three frosted 150-watt or six frosted 200-watt incandescent light bulbs located 8 inches below the glass inspection surface. The light output of the bulbs could be varied from zero to maximum by means of a 1,000-volt-ampere variable voltage autotransformer having a voltage output ranging from 0 to 135 volts.

Filters for use with the candling table were cut 12 inches wide by 24 inches long to fit the top of the table. The filter used to obtain white light was opal glass, and green, blue, yellow, and red filters were made from translucent colored acrylic plastic 1/8-inch thick to obtain colored light. A 500-watt R-2 Photoflood bulb was mounted above the table to illuminate the surface of the table and provide a variable source of incident light. This bulb also was supplied with a source of voltage ranging from 0 to 135 volts. A Western Photronic Foot-Candle Meter, Model 614, equipped with a visual correction filter for color, was used to measure the amount of transmitted light.

In this study 245 medium-sized cod fillets representative of a normal commercial pack were examined. These fillets ranged between 0.5 and 1.25 inches in thickness and between 11.5 and 20 inches in length. Each fillet had an average of 7.7 parasites. To determine the effect of color and light intensity, the incident light was adjusted to the desired intensity and measured as foot-candle

(over)

 ABSTRACTER: Martin Heerdt

MALODOR FROM MEAL DRIER

SILO STORAGE OF FISH MEAL

INSPECTION OF FROZEN TUNNY

LIGHT FOR CANDLING FILLETS

6.14

Feeding results. -- Quantities of whole meal bulk-stored in silos and stored in paper bags were used for feeding experiments with pigs and chickens. These experiments showed no difference regarding the rate of growth of the animals and the quality of the slaughter.

7.89

units on the surface of the table. Each fillet was examined, respectively, at transmitted light levels of 0, 5, 10, 50, 100, 200, and 300 foot-candles, all the visible parasites were removed, and their number was recorded. The transmitted light was then increased to the next level, the fillets were re-examined, and any additional visible parasites were removed and recorded. The fillets then were shredded with a knife, and the number of residual parasites that had escaped detection was recorded. The above procedure was repeated at incident light levels of 0, 10, 50, 100 foot-candles with white, green, blue, yellow, and red filters on the candling surface.

Results. --The numbers of residual parasites were calculated as percentages of the total numbers of parasites; these values were then plotted against the intensity of the transmitted light. With an incident light value of zero, that is, in a darkened room, all but 27 percent of the parasites could be removed with red and white light. Blue, green, and yellow light, respectively, allowed 30, 30, and 37 percent of the parasites to remain undetected. At 10-foot-candles of room lighting, a higher level of transmitted light was needed to detect parasites, and white light proved to be the better choice for candling. As the incident light value was increased to 50-foot-candles, the candling operation became less efficient, and white and green colored filters were best. At an incident light value of 100-foot-candles, candling became even less efficient, and white and green filters gave the best results.

Conclusions. -- Parasites more then $\frac{1}{4}$ inch below the surface, or in the brown flesh on the skin side of the fillet, or under the silver bloom are unlikely to be detected by candling. In a completely darkened room no more than 10-foot-candles of transmitted light is required for candling cod fillets. In a room illuminated to a level of 10-foot-candles, approximately 50-foot-candles of transmitted light is required. For efficient candling, an incident light value of 3-to 5-foot candles and a transmitted light value of approximately 50-foot-candles should be used without a filter, that is, using white light.

6.134

A scrubber designed to use the available water and perform effectively should fulfill the following requirements: (1) it should be simple to fabricate from cheap materials that are resistant to abrasion and salt-water corrosion; (2) it should be designed so that it cannot be plugged by refuse that is not easily filtered from the river water; (3) the pressure drop through the packed section should be sufficiently low to permit the existing single fan on the drier to maintain the required air flow through the drier, cyclone, and scrubber; and (4) commensurate with other requirements, it should have the best possible gas-liquid contracting efficiency to achieve the maximum absorption of odorous chemicals from the gases.

To avoid difficulties caused by plugging with solids and to retain the higher contacting efficiency of a packed tower, it was decided to develop a scrubber packed with vertical asbestos-cement plates. Corrugated plates were chosen since it had been shown (1) that mass transfer coefficients using corrugated plates were about $1\frac{1}{2}$ times as great as those obtained with flat plates.

A model scrubber was made from two corrugated asbestos-cement sheets. Using this scrubber, flooding velocities and pressure drops were determined for use in designing a plant-scale unit.

Design and testing of plant-scale deodorizer. -- The full-scale scrubber was built and connected to the outlet from a small drier at the fish-reduction plant of B.C. Packers Ltd. at Steveston, British Columbia.

The effectiveness of water-scrubbing at the plant confirmed the laboratory results. Water-scrubbing alone removed all of the fishy odors and much of the burnt-protein smell. Only a faint burnt odor was perceptible in the scrubbed drier gases. Chlorine or ozone added to the scrubbed gas in very small amounts reduced or eliminated this faint residual smell.

Discussion. -- Results of this work indicate that an efficient water-scrubbing of the exhaust gases from a flame fish-meal drier will remove the nuisance caused by their objectionable odors. In cases where the amount of odor released from the plant must be very small, gaseous chlorine or preferably ozone may be used for treating the scrubbed gases. Great care, however, will also be necessary to keep the plant and docks clean and to eliminate all other sources of smells if the process is to operate completely free of objectionable odors.

7.89

7.80 CHEMICAL EXAMINATION OF FRESHNESS OF FISH

Wierzchowski, J.
Przemysl Spozywczy 10, No. 4, p. 162 (1956) (In Polish)
Food 26, No. 305, p. 85 (Feb. 1957) (London, England) (In English)
World Fisheries Abstracts 9, 47-48 (May-June 1958)

The chemical changes resulting from bacterial attack are discussed, particularly the formation of ammonia bases, amines, indole, acetic acid, etc., and the conventional methods to establish the degree of decay are reviewed. Attention is drawn to a Russian method based on the examination of fish in ultraviolet light. The formation of ammonia and ammonia bases in lean and fat fish is studied as determined by straight steam distillation and, alternatively, by the microdiffusion method. It was found that the latter gives the more accurate results, as steam distillation is apt to cause some additional destruction of protein. For lean fish, such as cod, 60 mg. of ammonia in 100 g. is regarded as the limit of fitness for consumption. It must, however, be realized that any renewing of the brine reduces the ammonia content without removing the bacterial decay. A content of 30 to 40 mg. of ammonia in 100 g. is taken as limit for fresh water fish. No simple relation between the ammonia content and the degree of freshness was found for herring. The examination of these must therefore be supplemented by other methods, also by the determination of the fat and water contents. It is interesting that in this respect, herring with more than 45% of water and less than 10% of fat, even when in an advanced stage of deterioration, contained very little free ammonia.

Recently Nessler's reagent has been used at the Soviet Research Institute for Oceanography and Fish Industry to develop a rapid ammonia test. Nessler's reagent is added to an extract of fish and the color developed is compared with that of standard solutions of $K_2Cr_2O_7$. The method, which has been adopted as the Russian Standard, was examined by the author and the results were found to agree closely with the microdiffusion tests when certain precautions relating to the preparation of the

(over)

Reprinted in whole

8.8 GRADING FISH FOR QUALITY 1. TRIMETHYLAMINE VALUES OF FILLETS CUT FROM GRADED FISH

Castell, C. H.; Greenough, Maxine F.; Rodgers, R. S.; and MacFarlane, A. S. (Fisheries Technological Station and Fish Inspection Laboratory, Halifax, Nova Scotia)
Journal of the Fisheries Research Board of Canada 15, 701-716 (July 1958)

Purpose.--This study is concerned with the quality of Atlantic cod (Gadus callarias) and Atlantic haddock (Melanogrammus aeglefinus) at the time they are being discharged from the vessel or shortly thereafter. Cod and haddock deteriorate rapidly in the plant, during transportation, and in wholesale and retail stores. The grade given to these fish on the wharf may bear no relation to their quality by the time they reach the consumer. The purpose of this study, which is a part of the grading program, is to improve the quality of cod and haddock as landed.

Experimental procedures.--Fish to be graded organoleptically in this study were placed in rows on long narrow tables in the station pilot-plant and evaluated as grade I, II, or III. Grade I quality consisted of fish that would yield good fresh fillets of superior quality and without discoloration or off-odors. Grade II quality consisted of fish that would yield fillets of merchantable quality but inferior to grade I fillets because of initial off-odors, slight discoloration, or softness. Grade III quality consisted of fish that would yield fillets with pronounced off-odors or discoloration and that should not be sold in the fresh or frozen fish trade. These grades were based primarily upon visible changes that had occurred in the eyes, gills, visceral cavity, and skin surface including the condition of the slime. Grading was facilitated by noting the firmness or elasticity of the muscle with the aid of finger pressure. These physical observations were supplemented by noting the development of odors in the gills and visceral cavity.

Determination of the trimethylamine (TMA) content was chosen as an objective method for assessing the quality of fish muscle. TMA values of the fillets were determined according to the method of Dyer (1945 and 1950).

(over)

ABSTRACTER: Martin Heerdt

8.53 THE CONTENT OF FAT AND FAT-FREE DRY MATERIAL IN NORWEGIAN WINTER HERRING DURING THE YEARS 1930-1956

Flood, Einar
Report on Technological Research Concerning Norwegian Fish Industry 3, No. 5, 9 pp. (1958) (Bergen, Norway)

Data on the content of fat and fat-free dry material of the Norwegian winter herring have been collected, based upon industrial analysis of a great number of separate catches during the years 1930-56.

In the tables and figures the annual catching season has been divided into 4 periods, and each catch placed according to actual date of catching.

The result proves that the fat-content of the winter herring is not constant but varies considerably year by year. It also diminishes during the catching season, the average figures declining from 12.5 to 9.6%.

On the other hand the content of fat-free dry material is a figure of more constant value year by year. These figures too show a small seasonal decline, the average dropping from 19.9 to 19.1%.

It is concluded by the author that the reason for the variation in the fat-content of the winter herring year by year depends firstly on the herrings' actual state of feeding when caught. This state may vary according to the food accessible to the herring in the migration waters. Secondly, it depends upon the constitution of the catch in regard to the age and maturity of the herring, the "unripe" youngsters usually being more fatty as compared to the average adults.

(over)

Author's summary

8.8 GRADING FISH FOR QUALITY 2. STATISTICAL ANALYSIS OF THE RESULTS OF EXPERIMENTS REGARDING GRADES AND TRIMETHYLAMINE VALUES

Hoogland, P. L. (Fisheries Technological Station, Halifax, Nova Scotia)
Journal of the Fisheries Research Board of Canada 15, 717-728 (July 1958)

Introduction.--The findings of a recent study made at this station in regard to the organoleptic grading of cod and haddock and the trimethylamine (TMA) content of these fish were subjected to statistical treatment.

Relation between grade and TMA values.--Analyses of the grade records of three panels of graders have shown the existence of a direct relation between the TMA index of a fillet and the grade of the round fish from which this fillet was cut. For each of the panels, a linear regression equation could be developed to describe the interdependence of these values. Specifically, a numerical grade may be established from a TMA value by use of the equation: Grade = 1.67 X TMA index + 0.91 in which the TMA index is log (1 + TMA value). At unit increments of TMA, the numerical grade obtained with these equations increases 0.2 of a grade unit, except at very low values of TMA. This demonstrated that TMA indexes of fillets may be used, with certain qualifications, as objective indicators of the true grade of the fish. A true grade is defined as the grade given to a fish by the "standard" panel of eight foremen.

The standard error with which the numerical grade may be estimated from the TMA index was found to be fairly large or 0.325. The author wishes to emphasize however, that these studies were made with mixtures of fish that contained a larger range of quality than would be expected to occur in a sampling of the same size in actual practice. The elimination of "bilgy" fish and "ping-pong" haddock both of which are known not to follow the TMA pattern would have caused a considerably

(over)

ABSTRACTER: Martin Heerdt

FRESHNESS TESTS

FAT CONTENT OF HERRING

TMA VALUE OF GRADED FILLETS

STATISTICAL ANALYSIS OF FISH GRADES

8.53

It is known that the constitution of the herring swarms as to age, may vary considerably year by year.

8.8

smaller standard error of estimate of grade. Handling of cod and haddock separately rather than combined also might have improved precision.

Even with the standard error as found, the authors were able to work out probabilities for fish with certain TMA values to be assigned grades I, II, or III. With the help of these values, a scale for practical grading could be developed. The limits of TMA value for grades I, II, and III, respectively, have been set as follows: 0.00 to 1.00, 1.01 to 7.00, and 7.01 and in excess of this value. This scale may need revision in the future.

A measure for the ability of graders to judge the quality of fish. --Commercial practice does not permit the grading of fish objectively with the aid of large numbers of TMA determinations. Subjective organoleptic grading is possible in commercial practice and probably will be performed by one grader in each fish plant. This will require a procedure by which it may be learned that (a) the grader has the correct judgment and (b) all graders in all plants do use, within limits, the same judgment. An indicator of a graders' ability to grade fish is the correlation coefficient that indicates the strength of the association between TMA index and grade. Comparison of these coefficients and the regression equations for different graders will show if their standards are the same. For the present, a minimum coefficient value of 0.5 determined on a sample of at least 150 fish of mixed quality might be a useful guide.

A method of rank correlation could be used in place of the method of product-moment correlation used throughout this study to determine the strength of the association between TMA index and grade. If fish would be assigned rank number 1, 2, or 3 according to their organoleptic grade and also according to their TMA value on the basis of some accepted scale, the strength of the association between the two rankings could be expressed by either Spearman's R or Kendall's τ coefficient of rank correlation. When this was tried out with Castell's data, the correlation coefficients were very high and indicated that the grader was competent.

7.80

fish extract and that of the reagent are taken.

The trimethylamine test, which is widely used in Canada as a measure of freshness of fish, has been examined by the author on a number of cod specimens, and the results are presented in the form of curves. It is shown that the degree of formation of trimethylamine is different from that of free ammonia bases and cannot be considered as a reliable means of establishing the decay in fish.

Another series of experiments dealt with the formation of indole which was suggested by some Russian workers as a suitable test for the purpose. According to this, p-dimethyl-o-aminobenzaldehyde is added to the steam distillate of the fish under examination and the ensuing color is compared with that of standard indole solutions treated in the same way. The author suggests the use of cobalt nitrate solutions as color standards.

8.8

Grading panels consisted of 4, 6, or 8 men. If six or more members of an 8-man panel agreed on a grade for a given fish, that grade was accepted and recorded. If a more pronounced division of opinion existed, the grades were recorded as a combination of I and II or II and III. Care was used to obtain miscellaneous lots of fish for these studies. Each lot included shore-caught and trawler-caught fish; gutted and ungutted fish; gilled and ungilled fish; well-iced, poorly-iced, and uniced fish; and fish that had been held in ice for 1 to 14 days. Immediately after the grading was completed, the fish were filleted; and the TMA value of the fillets was determined.

Results. --About 90 percent of the fish evaluated as grade I by the panel contained 0 to 1.0 mg. of TMA nitrogen per 100 g. of muscle. About 75 percent of the fish evaluated as grade II by the panel contained 1 to 5 mg. of TMA nitrogen per 100 g. of muscle. About 90 percent of the fish evaluated as grade III by the panel contained 5 to 7 mg. of TMA nitrogen per 100 g. of muscle. Fish of grade I quality corresponded to the 0- to 6-day portion of a characteristic TMA curve of plotted data for iced cod and haddock. Fish of grade II quality corresponded to the 6- to 9-day portion of a characteristic TMA curve of plotted data for iced cod and haddock. Fish of grade III quality corresponded to the 9- to 10-day portion of a characteristic TMA curve of plotted data for iced cod and haddock. TMA values between 0 and 1 indicate fish judged to be of prime quality. TMA values between 1 and 5 indicate fish judged to be spoiling but still available for producing merchantable fillets. TMA values in excess of 5 indicated fish that were judged to have reached a condition unfit for processing for sale as fresh or frozen fillets.

This study does not presume to establish TMA values for separating the fish into grades as indicated above. Niether does this study show that there should be only three grades. These points need further consideration in the light of economic practice and commercial grading experience. This study does show (1) that experienced graders can consistently separate fish into three different grades and (2) that the TMA value of the fish muscle from fillets cut from these fish has a significant correlation with the assigned grade.

0.36 CHANGES IN MUSCLE AFTER DEATH

Bate-Smith, E. C. and Bendall, J. R.
Brit. Med. Bull. 12, 230-235 (1956)
Food Science Abstracts 29, 207 (June 1957)

A review dealing with: (1) physical changes in muscle during rigor mortis; (2) chemical changes; (3) the relation of physical and chemical changes; (4) temperature coefficients of physical and chemical changes, and (5) other changes associated with stiffening.

0.36 (Cross Reference 7.89)

RIGOR MORTIS AND THAW RIGOR IN LAMB

Marsh, B. B. and Thompson, J. F. (Meat Industry Research Institute of New Zealand, Wellington)
Journal of the Science of Food and Agriculture 9, 417-424 (July 1958)

The onset of rigor mortis in the longissimus dorsi muscle of the lamb has been studied with particular emphasis on the effect of temperature on its time-course. With the introduction of faster-freezing techniques in the frozen lamb industry, part of the carcass may be frozen before the onset of rigor mortis. It is shown, however, that the extreme shortening and loss of 'drip' characteristics of thaw rigor in isolated muscles will not occur if the muscles remain attached to the skeleton and thawing is not accelerated.

0.4 IDENTIFICATION OF ESTRADIOL-17β FROM DOGFISH OVA (SQUALUS SUCKLEYI)

Woltz, Herbert H., Botticelli, Charles, Hisaw, Frederick L., Jr.; and Ringler, Ira
Journal of Biological Chemistry 231, 589-592 (April 1958)

A material identified as estradiol-17β by counter-current distribution, paper chromatography, and comparative estrogenic action was extracted from the ovarian eggs of dogfish (Squalus suckleyi).

0.4 MARINE BIOTOXINS: ISOLATION AND PROPERTIES

Courville, Donovan A.; Halstead, Bruce W.; and Hessell, Donald W. (Coll. of Med. Evangelists, Loma Linda, Calif.)
Chem. Revs. 58, 235-48 (1958)
Chemical Abstracts 52, 11998 (July 25, 1958)

Review with 117 references.

2.118 CONTINUOUS FREEZING OF FISH ON BOARD SHIP

Sadorge, M.
Proc. 9th int. Cong. Refrig., Paris, pp. 4 111-4 115 (1955)
Food Science Abstracts 29, 423 (October 1957)

Developments in the freezing of fish at sea are reviewed. The advantages and disadvantages of the multi-plate freezer are discussed, with particular reference to the installation on the French trawler "Jacques-Coeur." A continuous freezer is described, and its advantages for use on board ship are outlined.

2.119 MOORAGE OF FISHING VESSELS AT PORT ORFORD, OREGON

Sanford, F. Bruce (U. S. Fish and Wildlife Service, Seattle 2, Washington)
Commercial Fisheries Review 19, 26-27 (June 1957)

2.1471 (Cross Reference: 1.0157)

COMMERCIAL TRAWLING IN THE PHILIPPINES

Manacop, Profirio R. (Bureau of Fisheries, Manila, Phillipines)
The Philippine Journal of Fisheries 3, 117-187 (July-December 1955)

During the last three decades, a trawl fishery of some magnitude was developed in the Philippines. This development was most significant during the postliberation period when the demand for fresh fish was great and the fishing business as a whole was enjoying an unprecedented boom. During the same period, improvements of the trawl gear and vessel equipment were made. Noteworthy among these improvements was the successful introduction and commercial adoption of the stern-set otter trawl from the Gulf and West Coasts of the United States.

2.1471 AN EXPERIMENT ON A MIDWATER TRAWL IV. ON ITS MECHANISM AND A TRIAL PRACTICE

Kobayashi, Kiichiro
Bulletin of the Faculty of Fisheries Hokkaido University 7, No. 1, 21-30 (May 1956) (English abstract, figures, and tables)

A study was made of the stability and utility of an experimental full-scale model of a midwater trawl fitted with two otter boards that were as light in weight as possible, a depressor for sinking the trawl net to any depth of sea water, and a depth indicator that indicates the depth of the net from the surface of the sea.

Common name	Other common names	Scientific name
Alewife	Branch herring, big-eyed herring, river herring,	Pomolobus pseudoharengus
	Blueback, glut herring, shad herring	Pomolobus aestivalis
Anchovy		Engraulis mordax
Cod	Codfish	Gadus morhua (Atlantic)
		Gadus macrocephalus (Pacific)
Flounder:		
Gray sole		Glyptocephalus cynoglossus
Lemon sole		Pseudopleuronectes dignabilis
Yellowtail	Dab	Limanda ferruginea
Dab	Sea dab	Hippoglossoides platessoides
Blackback	Winter flounder	Pseudopleuronectes americanus
Fluke	Summer flounder, gulf flounder, flounder	Paralichthys species
'Sole'		Pleuronectidae and Bothidae species
'California halibut'		Paralichthys californicus
Haddock		Melanogrammus aeglefinus
Halibut		Hippoglossus hippoglossus (Atlantic)
		Hippoglossus stenolepis (Pacific)
Herring:		
Lake	Herring	Leucichthys artedi (Great Lakes, except Erie)
Round		Etrumeus sadina
Sea		Clupea harengus (Atlantic)
Thread		Clupea pallasii (Pacific)
		Opisthonema oglinum
Jack mackerel	Horse mackerel	Trachurus symmetricus
Lingcod	Cultus cod, blue cod, buffalo cod, ling	Ophiodon elongatus
Mackerel		Scomber scombrus (Atlantic)
		Pneumatophorus diego (Pacific)
Crab:		
Blue		
Hard	Hard-shelled crab	Callinectes sapidus
Soft and peelers	Soft-shell crab	Callinectes sapidus
Dungeness		Cancer magister
King	Alaska king crab	Paralithodes camtschatica
Rock		Cancer irroratus (New England)
		Cancer species (California)
Stone		Menippi mercenaria
Lobster:		
Northern		Homarus americanus (Atlantic)
Spiny	Sea crawfish, rock lobster	Panulirus argus (Atlantic)
		Panulirus interruptus (Pacific)
Shrimp	Prawn	Penaeus setiferus (South)
		Penaeus duorarum (Atlantic)
		Penaeus aztecus and Xiphopeneus kroyeri Gulf)
		Pandalus species (Atlantic and Pacific)
		Pandalopsis species (Pacific)
		Crago species (Pacific)

Common name	Other common names	Scientific name
Menhaden	Mossbunker, pogy, fatback	Brevoortia species
Mullet	Jumping mullet, striped mullet, silver mullet	Mugil species
Ocean perch:		
Atlantic	Rosefish, redfish, red perch	Sebastes marinus
Pacific		Sebastodes alutus
Pilchard	Sardine	Sardinops caerulea
Pollock	Boston bluefish	Pollachius virens
Rockfish	Rock cod, snapper	Sebastodes species (Pacific)
Sablefish	Black cod	Anoplopoma fimbria
Salmon:		
Atlantic		Salmo salar (Atlantic)
Pacific:		
Chinook or king	Tyee, spring	Oncorhynchus tshawytscha
Chum or keta	Fall, dog	Oncorhynchus keta
Pink	Humpback	Oncorhynchus gorbuscha
Red or sockeye	Blueback	Oncorhynchus nerka
Silver or coho		Oncorhynchus kisutch
Spanish mackerel	Mackerel	Scomberomorus maculatus
Tuna and tunalike fishes:		
Albacore	Longfin tuna	Germo alalunga
	---	Thunnus saliens
Bluefin	Horse mackerel	Thunnus thynnus
	---	Thunnus secundodorsalis
Bonito		Sarda sarda (Atlantic)
		Sarda chiliensis (Pacific)
Little	Bonito, albacore, false albacore	Euthynnus alletteratus
Skipjack	Striped tuna	Katsuwonus pelamis
Yellowfin		Neothunnus macropterus
Whiting	Silver hake	Merluccius bilinearis
Clam:		
Cockle		Cardium corbis (Pacific)
Coquina	Pompano shells	Donax variabilis
	Butter	Saxidomus nuttali (Pacific)
	Little neck	Paphia staminea (Pacific)
Hard	Round clam, cherrystone, quahog, little neck	Venus mercenaria (Atlantic)
		Venus mortoni (Florida)
Ocean quahog		Cyprina islandica
Pismo		Tivela stultorum (Pacific)
Razor		Ensis species (Atlantic)
		Siliqua patula (Pacific)
Soft	Soft-shell clam, sand clam, nannynose, maninose	Mya arenaria
Surf	Skimmer	Spisula solidissima
Oyster:		
Eastern	Cove	Crassostrea virginica
Pacific (introduced)	Japanese	Crassostrea gigas
Western	Olympia, native	Ostrea lurida
Scallop:		
Bay		Pecten irradians (Atlantic)
		Pecten aequisulcatus (Pacific)
Sea		Pecten magellanicus

* Taken from Fishery Statistics of the United States 1955. Each species listed was caught in excess of 10,000,000 pounds in 1955.

4.11 RADIOMETRIC ESTIMATION OF UNSATURATED FATTY ACIDS ON CHROMATOGRAMS

Budzynski, A. Z.; Zubrzycki, Z. J.; and Campbell, I. G. (Institute of Nuclear Research, Warsaw, Poland)
Nature 182, 178-179 (July 19, 1958)

Iodine-131 was used to develop a method for quantitative estimation of unsaturated fatty acids that have been separated by partition paper chromatography.

4.11 PHYSIOLOGICALLY ACTIVE CHOLINE ESTERS IN CERTAIN MARINE GASTROPODS AND OTHER INVERTEBRATES

Keyl, M. L.; Michaelson, I. A.; and Whittaker, V. P. (Univ. Cambridge, Engl.)
J. Physiol. (London) 139, 434-54 (1957)
Chemical Abstracts 52, 10443 (June 25, 1958)

Tissues were extracted with ice-cold 10 percent trichloroacetic acid, and the choline esters thus obtained were identified by comparison with known compounds in biological assays and chemical procedures, including column and paper chromatography and ultraviolet spectrophotometry.

4.13 XXII. EXAMINATION FOR THE OCCURRENCE OF C_{16}-C_{22} DIENOIC AND C_{20} TRIENOIC ACIDS IN SARDINE OIL

Anonymous
Mem. Fac. Eng. Nagoya Univ. 9, 347-52 (1957)
Abura Kagaku 7, 13-16 (1958)
Chemical Abstracts 52, 11446 (July 10, 1958)

An octadecadienoic acid was separated; no others could be separated.

4.13 LIPIDES OF THE MUSCLE OF TUNA, THUNNUS ORIENTALIS. I. ACETONE-SOLUBLE LIPIDE OF THE ORDINARY MUSCLE

Igarashi, Hisanao; Zama, Koichi; and Katada, Muneo (Hokkaido Univ., Sapporo)
Nippon Suisan Gakkaishi 22, 787-90 (1956-57)
Chemical Abstracts 52, 12250 (July 25, 1958)

II. Acetone-soluble lipide of the dark-colored muscle. --Ibid. 791-4.

4.15 ETHER-EXTRACTED OILS FROM CUTTLEFISH LIVER OF LOW OIL CONTENT AND RESIDUE OF CUTTLEFISH OIL RENDERING

Toyama, Yoshiyuki; Takai, Hideko; and Yamada, Minoru
Yushi Kagaku Kyokaishi 2, 152-4 (1953)
Chemical Abstracts 52, 11446 (July 10, 1958)

4.15 OILS FROM CUTTLEFISH (OMMASTREPHES SLOANI PACIFICUS) AND MACKEREL (SCOMBER JAPONICUS)

Yamada, Minoru; Takai, Hideko; Mizuta, Masateru; and Toyama, Yoshiyuki
Yushi Kagaku Kyokaishi 2, 149-52 (1953)
Chemical Abstracts 52, 11446 (July 10, 1958)

4.29 THE HIGHLY UNSATURATED ACIDS IN SARDINE OIL. XXI. ULTRAVIOLET ABSORPTION SPECTRA FOR ALKALI-ISOMERIZED POLYETHENOID ACID COMPONENTS OF SARDINE OIL

Shimooka, Tsutomu and Toyama, Yoshiyuki
Abura Kagaku 6, 314-21
Mem. Fac. Eng. Nagoya Univ. 9, 335-46 (1957)
Chemical Abstracts 52, 11445 (July 10, 1958)

C_{22}-hexaenoic, C_{22}-pentaenoic, C_{20}-pentaenoic, C_{20}-tetraenoic, C_{18}-tetraenoic, C_{18}-trienoic, and C_{16}-trienoic acids were separated as their Me esters by fractional distillation and silica-gel chromatography.

4.29 UTILIZATION OF THE LIVER OIL OF DEEP-SEA SHARKS XII. PREPARATION OF POLYMERIZED PRODUCT FROM SQUALENE. 1. POLYMERIZATION OF SQUALENE WITH ACID CLAY AS THE CATALYST

Higashi, Hideo; Izeki, Shigeo; and Asano, Motoaki (Tokaiku Regional Fisheries Expt. Sta., Tokyo)
Nippon Suisangaku Kaishi 22, 378-82 (1956-57)
Chemical Abstracts 52, 9631 (June 10, 1958)

LIST OF PUBLICATIONS REGULARLY ABSTRACTED

Analyst
Analytical Chemistry
Archives of Biochemistry and Biophysics
Biochemical Journal
Biochemistry
Bulletin of the Faculty of Fisheries, Hokkaido University
Bulletin of the Japanese Society of Scientific Fisheries
California Fish and Game
Canadian Fisherman
Canadian Journal of Chemical Engineering
Canadian Journal of Chemistry
Canner and Freezer
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Processing
Chemistry and Industry
Commercial Fisheries Review
Drug and Cosmetic Industry
FAO Fisheries Bulletins
Federation Proceedings
Feed Bag
Feedstuffs
Fisheries Newsletter (Australia)
Fish. Res. Bd. Can., Prog. Repts. Atlantic Coast Stas.
Fish. Res. Bd. Can., Prog. Repts. Pacific Coast Stas.
Fishing Gazette
Food Engineering
Food Manufacture
Food Packer
Food Preservation Quarterly
Food Processing
Food Research
Food Science Abstracts
Food Technology
Frosted Food Field
Industrial and Engineering Chemistry
Industrial Refrigeration
Journal of Agricultural and Food Chemistry
Journal of Applied Chemistry
Journal of Biological Chemistry
Journal of Nutrition
Journal of the American Chemical Society
Journal of the American Dietetic Association
Journal of the American Oil Chemists' Society
Journal of the Association of Official Agricultural Chemists
Journal of the Fisheries Research Board of Canada
Journal of the Science of Food and Agriculture
Maine Coast Fisherman
Modern Packaging
Modern Refrigeration
National Fisherman
National Provisioner
Nature
Nutrition Reviews
Pacific Fisherman
Poultry Science
Progressive Fish-Culturist
Quick Frozen Foods
Refrigerating Engineering
Report of the Food Investigation Board (Great Britain)
Science
Seafood Merchandising
Trade News (Fisheries Department, Canada)
Western Fisheries
World Fisheries Abstracts
World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above-listed publications are included. Biological papers are generally omitted.

4.61 THE EFFECT OF ASCORBIC ACID ON THE AUTOXIDATION OF FATS. EXPERIMENTS WITH SALT HERRING

Marcuse, R. (Swed. Inst. Konservierungsforschung, Göteborg)
Fette, Seifen, Anstrichmittel 58, 1063-6 (1956)
Chemical Abstracts 52, 9470 (June 10, 1958)

At low concentrations (0.1 to 0.5 percent) and at low values, ascorbic acid had a prooxidative effect on salt herring, while at higher concentrations, it produced an antioxidative action. The effect of the ascorbic acid depended on pH as well as concentration; antioxidative action increased with increasing pH, and at higher pH values even low concentrations of ascorbic acid acted as antioxidants.

4.61 USE OF ANTIOXIDANTS IN THE STORAGE OF FROZEN FISH

Perepletchik, R. R.
Rybnoe Khoz. 32, No. 10, 80-6 (1956)
Chemical Abstracts 52, 12263 (July 25, 1958)

"Salaka," a kind of sprat, were frozen in blocks (900 to 1500 g. of fish) and then glazed with H_2O, glutamic acid, Na glutamate, and mixtures of ascorbic and citric acid. The treated fish were stored at -15° and -25° for 1 to 10 months. Data are given for the peroxide number and iodine number of the extracted fat and for the organoleptic appraisal of the glazed and unglazed fish. Salaka, glazed with 0.2 percent Na glutamate or a mixture of ascorbic acid and citric acid (0.2 percent), were successfully stored at -15° for 6 months. Salaka, glazed with 0.1 percent glutamic acid, were preserved at -25° for 7 months and at -15° for 5 months in comparison with a maximum of 2 months storage at -15° when glazed with H_2O.

6.133 SEPARATION OF FISH OIL FROM MARINE PRODUCTS

Tada, Seiji and Nakamura, Taiju
Japan 327 (Jan. 23, 1957)
Chemical Abstracts 52, 4217 (March 10, 1958)

6.134 A STEAM-HEATED DRIER OF NOVEL CONSTRUCTION AND GREATLY REDUCED DIMENSIONS

Solheim, P.
Konkyliene 1, 17-20 (December 1956)

(Abstract of this article appears under 2.118 page 3 - November 1957)

6.135 DEODORIZATION OF FISH OIL

Shizuo, Takumi et al. (to Tsutomu Kuwada)
Japan 284 (Jan. 20, 1956)
Chemical Abstracts 51, 4031 (March 10, 1957)

Hydrogenation of whale oil (I number 117.5) with 0.2 percent Ni catalyst (cf. C.A. 50, 3784a) and H at normal pressure for 5 hours at 110° gave a product with I number 82 and free from fishy odor.

6.249 STUDIES ON THE LIPOXIDASE IN FISH TISSUES I. OXIDATION OF VITAMIN A BY THE EXTRACT OF SOME FISH LIVER

Ono, Toyoki and Nagayama, Fumio
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 4, 206-210 (1957) (English synopsis, tables, and figures)

The vitamin-A oxidizing enzyme in fish liver was a lyo-form and was found not only in mackerel liver but in perch liver. The enzyme possessed a special thermal property, having increased activity at 60° C.

6.249 STUDIES ON THE LIPOXIDASE IN FISH TISSUES II. LIPOXIDASE ACTION OF LIVER AND DARK MUSCLE

Ono, Toyoki and Nagayama, Fumio
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 4, 211-214 (1957) (English synopsis and figures)

The authors found that extracts of liver and of dark muscle of fish oxidize β-carotene in the presence of linoleate.

6.3 THE WATER AND IODINE CONTENTS OF SOME PACIFIC COAST KELPS

Cameron, A. T. (University of Manitoba, Winnipeg, Canada)
Contributions to Canadian Biology (Supplement to the 5th Annual Report of the Department of Naval Service, Fisheries Branch), Sessional Paper No. 38a, 169-173 (1916)

Data are given on the percent of water and the percent of iodine in Laminaria bullata, Laminaria saccharina, Costaria turneri, Nereocystis lutkeana, Macrocytis pyrifera, Alaria tenuifolia, Fucus furcatus, and Fucus evanescens.

6.30 FISH MEAL 14. DRYING OF SEAWEED

Dreosti, G. M. and Lewis, A. M.
Annual Report of the Fishing Industry Research Institute, 1955-1956, Cape Town, South Africa 9, 30 (1957)

Stipes of Ecklonia maxima that had been sun-dried to 25 percent moisture were cut into half-inch slices and dried in a cabinet dehydrator in air traveling at 200 lineal feet per minute. Drying for 25 minutes at 260° F. reduced the moisture content to 9.8 percent without scorching, whereas drying for 20 minutes at 320° F. produced a noticeable scorching of the seaweed. The speed of drying was increased either by slicing the stipe to expose the inner surfaces to the air or by hammering 6-inch lengths of stipe to break the epidermis in many places.

INDEX

Subject	Page No.	Card No.
Analysis, organic		
Analysis of choline esters	15	4.11
Radiometric assay of fatty acids	15	4.11
Electrophoresis of protein	19	7.51
Chromatographic assay for insulin	19	7.51
Antioxidants		
Enzymatic antioxidant	7	4.60
Autoxidant for salt herring	17	4.61
Antioxidants for frozen fish	17	4.61
Byproducts, miscellaneous		
ATP as Browning inhibitor	19	6.71
Arginine from pyloric caeca	19	6.72
Gelatine from cod	19	6.80
Chitin from shrimp shells	19	6.82
Fish scales for gelatin or guanine	19	6.84
Chemistry and biochemistry, miscellaneous		
Muscle changes after death	13	0.36
Rigor mortis and thaw rigor in lamb	13	0.36
Composition, organic		
Fat content of herring	11	8.53
Dienoic and trienoic acids in sardine oil	15	4.13
Lipides of tuna	15	4.13
Oils from cuttlefish and mackerel	15	4.15
Oils from cuttlefish liver	15	4.15
Factoryships		
Freezing on board	13	2.118
Fish liver oils, manufacturing of		
Lipoxidase in fish livers	17	6.249
Fish meal and oil, manufacture		
Malodor from meal drier	9	6.134
Silo storage of fish meal	9	6.14
Extraction of oil	17	6.133
Deodorizing whale oil	17	6.135
Fishing methods		
Trap fishing	1	2.1474
Lath-spacing in lobster traps	3	2.1474
Trawling in the Philippines	13	2.1471
Japanese midwater trawl	13	2.1471
Freshness of fish		
Inspection of frozen tunny	9	7.89
Light for candling fillets	9	7.89
Freshness tests	11	7.80
TMA value of graded fillets	11	8.8
Statistical analysis of fish grades	11	8.8
Frozen fish, changes in during freezing and cold storage		
Fast versus slow freezing	5	3.239
Measurement of fish toughness	5	3.2495
Freezing mussels	5	3.2496
Frozen fish, packaging		
Frozen fish packaging	3	3.2383
Handling fresh fish		
Darkening of shrimp	3	2.3
Marine plant products		
Water and iodine content of kelp	17	6.3
Seaweed dehydration	17	6.30
Amino acid composition of Porphyra tenera	19	6.32
Degradation of laminarin	19	6.32
North America, Alaskan fisheries and U. S. Territories		
Red flesh in Sebastes marinus	1	2.00
Nutrition and medicine, general		
Marine biotoxins	13	0.4
Estradiol from dogfish ova	13	0.4
Oils, chemical and physical properties		
Polymerization of squalene	15	4.29
Unsaturated acids in sardine oil	15	4.29
Preserved fish, miscellaneous		
Storage of cured anchovies	7	3.8
Preservatives and sanitation		
CTC-treated fillets	3	3.12
Salt fish		
Disinfecting red halophilic bacteria	7	3.5
Thermocouple controls for drying	7	3.5
Sharks		
Australian shark fishery	1	1.70
Spoilage		
Pathogenic bacteria in precooked foods	1	2.05
Sterilization of canned fish	5	3.33
Vessels, fishing		
Moorage of fishing vessels	13	2.119

6.32 STUDIES ON THE SAVOR OF MARINE ALGAE III. CONTENTS OF FREE AMINO ACIDS IN THE LAVER, PORPHYRA TENERA

Tsuchiya, Yasuhiko and Sasaki, Takashi
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 4, 230-233 (1957) (English synopsis, tables, and figure)

Glycine, alanine, valine, leucine, isoleucine, proline, phenylalanine, serine, threonine, arginine, lysine, aspartic acid, and glutamic acid were found by microbiological assay, but tyrosine, tryptophan, methionine, and histidine were not recognized.

6.32 BARRY DEGRADATION OF LAMINARIN

Hirst, E. L.; O'Donnell, J. J.; and Percival, Elizabeth (University of Edinburgh, Scotland)
Chemistry and Industry No. 26, 834 (June 28, 1958)

Recent work on insoluble laminarin has revealed the presence of some β-1:6-glucosidic linkages. The molecule therefore may consist of unbranched chains of β-1:3-linked glucose units occasionally interrupted by β-1:6-links, or it may be branched. Unless the 1:6-links occur exclusively near the ends of the chains, the results now recorded support the idea of a branched structure for the laminarin molecule.

6.70 POTENTIAL BYPRODUCTS FROM ALASKA FISHERIES: UTILIZATION OF SALMON EGGS AND SALMON WASTE

Kyte, R. M.
Commercial Fisheries Review 20, 1-5 (March 1958)

(Abstract of this article appears under 6.9 page 11 - August 1958)

6.71 NEW BROWNING INHIBITOR

Anonymous
Food Engineering 28, 165 (June 1956)

Enzymatic browning of various fruits and vegetables when peeled, cut, or pulped can be controlled to a large extent by treatment with adenosine triphosphate, as revealed in a recent patent, U. S. Patent 2,738,280, March 13, 1956.

6.72 II. PREPARATION OF ARGININE FROM PYLORIC CAECA EXTRACT

Kakimoto, Daiichi and Yoshimine, Tetsuo
Nippon Suisan Gakkaishi 22, 320-3 (1956-57)
Chemical Abstracts 52, 8254 (May 25, 1958)

6.80 RESEARCHES ON THE POSSIBILITY OF OBTAINING GELATINE FROM INEDIBLE PARTS OF COD

Czapke, K.
Prace Morsk. Inst. Ryback, Gdyni No. 7, pp. 241-244 (1954)
Food Science Abstracts 28, 569 (December 1956)

A method for preparing gelatine from the skin and swim-bladder of the cod is described. Good quality, odorless gelatine could be obtained, of marked swelling capacity, with a melting point at about 26° C.

6.82 A MATERIAL OF MANY USES THAT CAN BE OBTAINED FROM SHRIMP SHELLS

Anonymous
Chemical Processing 19, 53 (August 1956)

6.84 FISH SCALES AS INDUSTRIAL RAW MATERIAL

Michniewicz, A.
Przem. Spozyw. 9, 326-327 (1955)
Food Science Abstracts 28, 462 (October 1956)

The use of fish scales for the production of guanine or gelatin depends greatly on the quality of the raw material; with material of poor quality, undesirable chemical changes occur, and these are likely to affect the quality of the finished products.

7.51 PROTEINS OF SHELLFISH II. PRETREATMENT PREVENTING THE ADSORPTION OF PROTEINS BY PAPER ELECTROPHORESIS OF LOW IONIC STRENGTH EXTRACTS OF MUSCLE OF MERETRIX MERETRIX

Baba, Haruo (Natl. Inst. Nutrition, Tokyo)
Nippon Suisangaku Kaishi 22, 420-3 (1956-57)
Chemical Abstracts 52, 10441 (June 25, 1958)

7.51 CHROMATOGRAPHIC ASSAY METHOD FOR DETERMINING INSULIN IN WHALE PANCREAS EXTRACTS

Sadano, Yuichi and Higashi, Katsumi
Yakugaku Zasshi 78, 424-7 (1958)
Chemical Abstracts 52, 12321 (July 25, 1958)

As a simple method for measuring the insulin content in solution, paper chromatography was adapted.

nited States
ent of the Interior
l Wildlife Service
ngton 25, D. C.

ial Business